

PACHYPSYLLA JAPONICA SP. NOV.,
A REMARKABLE LERP-FORMING PSYLLID FROM JAPAN*
(HOMOPTERA : PSYLLIDAE)

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The genus *Pachypsylla* RILEY, 1885 is composed entirely of gall-forming species which inhabit *Celtis* spp., the hackberries and it consists of seven species known only from North America up to now. CRAWFORD (1914) put this genus into the tribe Pachypsyllini of the Psyllinae with the genera *Tetragonocephala* and *Uhleria*, both of which were from North America. The genus *Uhleria*, however, was proved not to be a native to North America but a introduced one and put into synonym of the Australian genus *Lasiopsylla* by TAYLOR in 1960. The genera *Pachypsylla* and *Tetragonocephala* thus remained in the tribe Pachypsyllini. HESLOP-HARRISON (1954) stated that these two genera might be originated to Australian ancestor basing upon some morphological characters and should be put into the subfamily Spondyliaspinae, most genera of which are endemic to Australia or New Zealand. It is still unsettled whether or not HESLOP-HARRISON is right.

The present new species was collected on the hackberry, *Celtis sinensis* var. *japonica* at Nose, Northern area of Osaka Prefecture, Japan in June of 1967, with additional specimens of some nymphs, lerps and galls. Consequently, their biology or life-history was partially clarified. Although this species is placed in *Pachypsylla* with some hesitation, it bears many characters identical with those of known *Pachypsylla* spp. The adult has a small and vertical head, with genal cones depressed strongly from plane of vertex. Thorax is large and strongly arched. Forewings are opaque and marginal cells are elongate. Male proctiger bears a typical epiphysis apically. The nymph has short and stout antennae, and the peculiar groups of lateral pores on the abdomen (FERIS, 1926) and the absence of the circum-anal pore ring reveal the marked characteristics of this genus. The adult of the species is described with brief notes on biology in the present paper, but the description of nymph and the biology or life-history will be given in detail in the future.

BOSELLI (1929) described only nymphs which seemed to fall within *Pachypsylla* as "Psyllide indeterminato" basing on material collected at Shanghai, E. China in October of 1924 by Silvestri from the leaves of *Celtis sinensis*. This species is almost identical with the present species in the shape and structure of the gall, the lerp ("follicolo" in his paper) - forming habit, and the sclerotization of the nymph, but its relationship is still

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obscure, since the adult of Chinese species is unknown yet. In 1926, FERRIS described only the last stage nymph collected from *Celtis reticulata* at Ridge Spring, Texas in July of 1921. He says: "this species forms a little, flat, waxen cell on the under side of the leaves of its host." And, "it is not at all impossible that it is the nymph of *Tetragonocephala flava* CRAWFORD....." This species is also allied to the present new species in some respects, the peculiarly specialized structure of the adult female genitalia and the lerp ("waxen cell")-forming habit of the nymph (if FERRIS's conjecture was correct), although the former is easily distinguishable from *Pachypsylla* spp. in the absence of metatarsal apical spines. The systematic relationship between the present new species and *Tetragonocephala flava*, as with *Pachypsylla* spp. of North America still waits a further study.

The lerp (test or waxen cell)-forming habit of the family is very common among the Australian genera, *Spondylaspis*, *Glycaspis*, *Cardiaspina*, *Hyalinaspis*, etc., and has been hitherto unknown from Japan. It is very interesting to consider how this habit appears in Japan and from where it comes from. The lerp-forming habit of the Japanese species may be consistent with HESLOP-HARRISON's theory that the modern representatives of *Pachypsylla* are derivatives of the Spondylaspinæ. More systematic study based on comparative morphology of both adult and nymph among the genera involved should be necessary to make this subject clear, however.

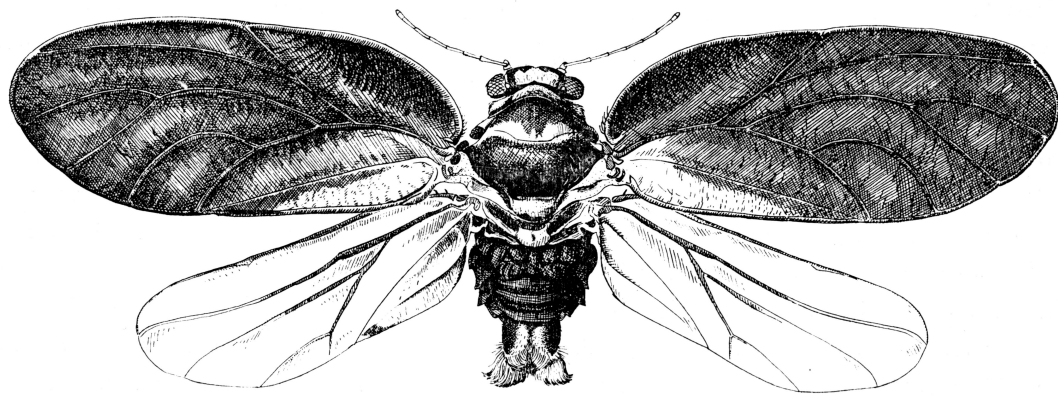


Fig. 1. Female of *Pachypsylla japonica* sp. nov. (drawing by Mr. I. HIURA)

Before going further, I wish to express my cordial appreciation to Mr. I. HIURA of this museum for enabling me to use his nice drawing and photographs and kind help in getting material. My deep thanks are also due to Prof. K. YASUMATSU of the Kyushu University and Dr. M. CHUJ of this museum for their kind advices and encouragements.

***Pachypsylla japonica* sp. nov.**

Color: General color reddish to dark brown with yellowish markings; antennae light brown with two apical segments dark brown to black; vertex yellowish or reddish brown with characteristic shiny black patterns as figured (Fig. 2—C), with anterior margins dark brown; genal cones dull brown, darker laterally, apices sometimes yellowish; eyes brown; ocelli orange. Pronotum light brown in the anterior half and dark brown in the posterior half. Praescutum brown with posterior margin broadly yellowish; mesoscutum, posterior margin of mesoscutellum and metapostnotum brown, mesoscutellum and metascutellum yellowish brown; mesothorax with anterior epipleurite distinctly black, even in case of the teneral form, with posterior epipleurite light brown. Forewings rather thick and coriaceous, dark brown and quite opaque, with transparent portion between clavus and A; veins dark brown, A light brown in basal three fourths. Hind wings somewhat brownish but nearly transparent, with brown veins. Legs yellowish brown, darker outwardly. Abdomen uniformly dark brown or black dorsally, with transverse stripes of lighter or yellowish brown ventrally; male genital segment light brown, with forceps black apically; female genital segment dark brown, dorsal valve narrowly or sometimes widely light brown along caudal margin, caudal depression of dorsal valve with many brush-like hairs of shiny brown.

Structure: Head small, about $\frac{2}{3}$ as wide as thorax, vertical; vertex quadrate, nearly straight on posterior margin, almost flat, rounded down to genal cones anteriorly, $\frac{3}{5}$ as long as wide, sparsely pubescent, with discal impressions small and shallow; genal cones broad, slightly divergent, blunt apically, slightly shorter than vertex, depressed from plane of vertex, densely pubescent; frons not visible; eyes small, hemispherical; antennae (Fig. 2—B) slender, about 1.4 times as long as width of head, with 1 long and 1 short setae at apex, segment X remarkably short, relative length of antennal segments as follows: 3:3:11:8:7:7:7:7:2:1.

Thorax large, very strongly arched, pubescent dorsally, laterally and ventrally; pronotum nearly vertical, about $\frac{2}{3}$ as long as vertex; praescutum half as long as wide, descending anteriorly; mesoscutum huge, strongly convex, about half as long as wide; mesoscutellum rectangular, $\frac{4}{7}$ as long as wide, anterior margin nearly straight, posterior margin rounded caudad; metascutellum small, rectangular, half as long as wide. Forewings (Fig. 2—A) large, rather wide basally, narrowly rounded apically, 2.4 times as long as wide, membrane slightly rugose, veins raised from surface and biserially set with small

setae; pterostigma almost obsolete; Rs moderately long, sinuate, not upcurved at apex; M sinuate, about $2/3$ as long as Rs; Cu_1 subparallel to Cu_2 ; relative length of veins $M+Cu$, Cu , Cu_2 as $6:10:13$; marginal cells elongate, medial slightly longer than cubital; clavus ended at apex of Cu_2 . Hind wings large, nearly $3/4$ as long as forewings, 2.6 times as long as wide, with prominent venation, $R+M+Cu$ heavily sclerotized, $S+Sc$ with 4 hooked and 7 straight microsetae basally. Legs thick, pubescent; posterior tibia without basal spur, with 2 outer, 4 posterior and 2 inner spines at apex; proximal segment of metatarsus with two apical spines, one inner and the other outer; meracanthus (Fig. 2—F) prominent, stout, projected ventro-caudad, subacute at apex. Abdomen (excl. genital segments) short, slightly longer than width of head, with short pubescence dorsally, with longer pubescence ventrally.

Male genital segment (Fig. 2—E) small, $1/3$ as long as the rest of abdomen, hairy; proctiger in lateral view stout, nearly 1.5 times as long as forceps, roundly produced caudad, with a distinct apical epiphysis slightly flexed caudad; anus opened at apex of apical epiphysis; forceps in lateral view broad at base, tapered to subacute apex, with apical portion slightly flexed caudad, with both margins sinuate, in caudal view strongly arched, somewhat O-shaped, both margins almost parallel, tapering to acute and touched apices, with inner surface bearing short retrorse setae; aedeagus long, basal segment about 1.6 times as long as apical segment, broad on apical half, apical segment with enlarged apex; subgenital plate subtriangular in lateral view, with dorsal margin sinuate. Female genital segment (Fig. 2—D) short, peculiarly specialized in shape and in structure; dorsal valve large, deeply concave caudally, in lateral view somewhat semicircular in shape, with long hairs along posterior margin, in caudal view median depression prominent, with many long, curling hairlike setae; inner valve almost as long as dorsal valve, projected ventrad; ventral valve very small, triangular in lateral view, pointing ventro-caudad, acute at apex.

Length of body ♂ 2.4—2.7 mm, ♀ 2.5—3.1 mm (to tip of folded wings ♂ 4.1—4.3 mm, ♀ 4.6—5.1 mm); length of forewing ♂ 3.4—3.6 mm, ♀ 4.0—4.3 mm; width of forewing ♂ 1.4—1.5 mm, ♀ 1.6—1.8 mm; length of antenna ♂ 1.1—1.3 mm, ♀ 1.2—1.3 mm; width of head ♂ 0.8 mm, ♀ 0.8—0.9 mm.

Holotype ♂: Hatsutani, Nose, Osaka Pref., 19. vi. 1967, on *Celtis sinensis* var. *japonica*, Y. Miyatake leg. (preserved in the collection of the Osaka Museum of Natural History).

Paratopotypes: 3 ♂♂ 1 ♀, 8. vi. 1967; 8 ♀♀, 19. vi. 1967; on the same tree as holotype, Y. Miyatake leg. *Paratypes*: 1 ♂, Shima-shima Valley, Nagano Pref., 5. vii. 1966, (beating), Y. Miyatake leg. 1 ♀, Hikosan, Fukuoka Pref., (beating), 27—29. vi. 1958, Y. Miyatake leg. (preserved in the collections of the Osaka Museum of Natural History, the Entomological Laboratory of Kyushu University, the British Museum of Natural History and the U. S. National Museum).

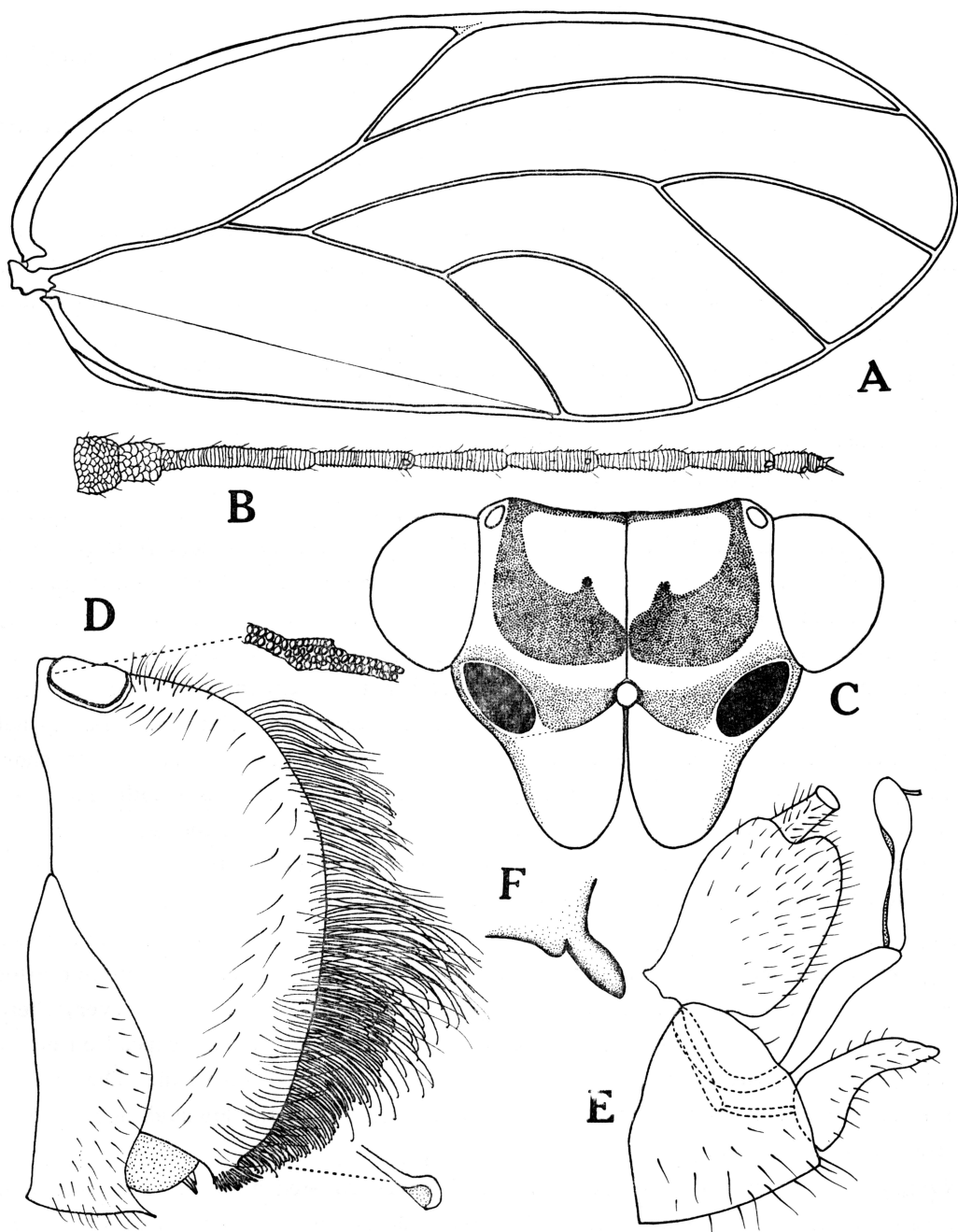


Fig. 2. *Pachypsylla japonica* sp. nov.

A. Forewing. B. Antenna. C. Head (antennae excluded), frontal view (showing maculation of vertex). D. Female genitalia, lateral view. E. Male genitalia, lateral view (same magnification as female genitalia). F. Meracanthus, lateral view (showing angle as it is).

Distribution : Japan (Osaka Pref., Nagano Pref., Fukuoka Pref.) ; E. China (Shanghai) (?).

Differs from *Pachypsylla* spp. of North America in having the genal cones larger and stouter, the pterostigma of forewing obsolete, the antennae much longer (1.4 times as long as width of head in *P. japonica*, and slightly longer than width of head or less in *Pachypsylla* spp. of N. America), the dorsal valve of female genitalia concave and much specialized, and the shape of gall and the lerp-forming habit of nymph. Differs from *Tetragonocephala flava* CRAWF. in having the proximal segment of metatarsus with a pair of apical spines.

Host plant : "Enoki"—*Celtis sinensis* PERS. var. *japonica* (PLANCH.) NAKAI [Ulmaceae].

Notes on biology : Although observations on the life history of this psyllid has not been completed yet, nor were many other important parts of its biology clarified, brief informations obtained up to now are given as follows.

This species seems to have two generations a year, although the adults of the autumnal (second) generation have not been confirmed. The nymphs of the summery form (the first generation) reach maturity by the end of May and the adults emerge from early June to July. The females seem to start laying eggs soon after mating. They grow continuously during summer and autumn, and reach maturity again sometime late in autumn. The autumnal adults may emerge in October or November and overwinter in the adult stage somewhere in the field as well as some other North American relatives. This is not certain yet, but speculative, however. It might help to prove these speculations to show that many young nymphs with small lerps were found on September 25th, 1967 and numerous full-grown, abandoned, lerps, most of which were fallen on the ground stickig with dead leaves, were found on January 20th, 1968 on or under the same hackberry tree, from which summeay adults had been taken previously.

So far as I know their host plant is strictly limited to the hackberry, *Celtis sinensis* var. *japonica*, but adults can be found on the different species of plants sometime after emergence. Although this plant is one of the commonest plant and abundant everywhere in Japan, there is not always much possibility to find this psyllid. It may depend on either a small quantity of the specis population or mechanism of their dispersal. The species seems to inhabit somewhat the mountainous district rather than the lowland according to collecting data of material.

Nymphs strictly live on the undersurface of leaves covered with peculiar shell-like lerps, forming ceratoneon pouch galls on the upper side of leaves. Usually one lerp, often two lerps or more, can be seen on one leaf. Sometimes two lerps are formed keeping close to each other (Pl. 1—F). A nymph is situated at the opening of gall (ostiole) in the supine position between a outside lerp and a thin wax membrane which closes the opening of gall. The autumnal nymph (the second generation), however, does not form

any gall but only lerp. This fact may cause to the limited period of gall plasticity of the host plant to this psyllid.

Soon after feeding starts, a hatched nymph begins to construct a lerp and seems not to make migration until maturity. When development is complete the fifth instar nymph leaves its lerp and settles down in an exposed position on the leaf surface where moulting to the adult stage occurs. Nymphs are frequently found parasitized by hymenopterous parasites, which is not identified yet. These parasites overwinter inside lerps in the pupal stage.

Gall : Color more or less yellowish or pale green ; process ceratoneon or spiniform as shown in picture (Pl. 1 — A), broadened basally, perpendicular or slightly inclined toward leaf surface, variable in length, ranging from 1 mm to 5 mm, usually 3 — 4 mm, apex more or less acute.

Lerp : Color whitish, waxy, more or less thick, scarcely semitransparent ; full-grown one typically circular, oval, clamshell-like or fan-shaped, sometimes elongate oval in case of being formed between contiguous leaf veins, the summery one frequently oval, less variable in shape than the autumnal one ; size variable according to shape, usually 5.0 — 6.0 mm in length (hinge to apex in case of the clamshell-like or fan-shaped one), 4.0 — 5.0 mm in width (or across), sometimes shorter than wide ; moderately convex in the autumnal one, less convex or almost flat in the summery one ; lerp constructed by addition of concentric (Pl. 1 — B, frequent in the summery form) or eccentric (Pl. 1, C — H, frequent in the autumnal form) layers of exudation, with more than ten obvious ridges on surface ; outer margin usually smooth, sometimes corrugated (Pl. 1 — E).

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摘 要

1. *Pachypsylla* 属のキジラミは、北アメリカから7種（全てエノキ属の植物にゴールを作る）知られているだけであるが、今度、大阪府北部の能勢においてこの属に入れるべきと思われる種が発見されたので *Pachypsylla japonica* と命名、記載した。成虫は長野県、福岡県からも得られている。
2. 成虫は6月上旬～7月と、10月下旬～11月（推定）の年2回発生。
3. 若虫はエノキの葉裏に寄生し、蠟状分泌物で作られた殻（lerp）の中にいる。日本のキジラミで若虫が殻を作る習性を持つ種類は、これまでに全く知られていない。
4. 第1化（夏期）の若虫が寄生した場合は葉表に角状のゴール（長さ3—4mm）ができるが、第2化（秋期）の場合はできない。
5. 終令若虫の殻（lerp）は長径5—6mm、短径4—5mmで、形は円形、卵形、長卵形（接近した葉脈の間に位置する場合）、ハマグリ形、扇形と変異が多い。第1令の殻を基礎に令が進むに従って層状に拡大してゆくのであるが、第1化の殻は同心的に成長し（写真—B）、第2化の殻は殆んど偏心的である（写真C—H）。
6. 本種の和名は、エノキカイガラキジラミ（若虫がエノキに寄生し貝殻状の殻を作る習性をもっていることに基く）と称する。

Explanation of Plate 1

- A—B: Galls and a lerp of the summery nymphs of *Pachypsylla japonica* Y. MIYATAKE (photographs by Mr. I. HIURA).
- A. Galls.
B. Lerp.
- C—H: Various lerp of the autumnal nymphs of *Pachypsylla japonica* Y. MIYATAKE.
- C. Clamshell-like lerp.
D. Elongate oval lerp.
E. Lerp with corrugated margin.
F. Two lerp formed keeping close to each other.
G. Thin and semitransparent lerp (vacant).
H. Two lerp showing differences of shape depending on their position or space between leaf veins.

